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RAPID HYPOTHERMIA SUBSEQUENT TO ORAL NICOTINIC ACID
AND IMMERSION IN WARM (30°C) WATER

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The purpose of this letter to the Editor is to describe the results of pilot studies conducted to evaluate body cooling by water immersion, with and without nicotinic acid. Nicotinic acid pretreatments resulted in greater body cooling than control trials. However cooling rates were less than can be achieved with evaporative cooling techniques. The striking feature of the nicotinic acid trials involved the magnitude of body cooling achieved in relatively temperate water (30°C).					
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The degree of multisystem tissue damage in heatstroke depends on both the magnitude and duration of hyperthermia. Although there are a variety of cooling techniques (1,2,3,4), the classical treatment for heat stroke involves immersing the patient in ice water or sponging with ice water and fanning (4). Unfortunately, the efficacy of these methods is reduced by cold-induced cutaneous vasoconstriction (3,4). Dramatic reductions in skin temperature (T_{sk}) also can cause shivering, which greatly elevates metabolic heat production. Thus, a method is required to facilitate body cooling in water warmer than the threshold T_{sk} for the onset of shivering (28°C). Nicotinic acid increases cutaneous blood flow and T_{sk} without significantly altering blood pressure or heart rate (5,6,7). It was hypothesized that this nicotinic acid-induced "flush" (7) would counteract vasoconstriction, and promote core cooling during immersion in cool water. The results of a preliminary test of this hypothesis are presented below.

The change in core temperature (T_c) of three healthy, normothermic males was studied during immersion in 25, 28 or 30°C water, with and without nicotinic acid pre-treatment. The subjects wore shorts and reclined on lounge chairs in water covering all skin below the neck. They ingested 1000 mg nicotinic acid and entered the water after a clearly visible flush had developed (range: 15-37 min). T_c was measured by either esophageal thermistor (subjects A and C) or rectal probe (subject B).


Nicotinic acid pretreatments resulted in greater body cooling



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than control trials. However, cooling rates (Table 1) were less than can be achieved with evaporative cooling techniques (3,4). Despite the fact that subjects A (age 47) and B (age 33) were considerably fatter than subject C (age 36), A and B exhibited more intense flushing and greater core temperature changes than subject C. Body cooling was greater in 30°C water than in 28 and 25°C, confirming that shivering and vasoconstriction counteract net heat loss. The striking feature of the nicotinic acid trials (Table 1) involved the magnitude of body cooling achieved in relatively temperate water (30°C).

The results of these pilot experiments suggest that a detailed investigation of the use of nicotinic acid as a pretreatment for cooling heat stroke victims is warranted. The following questions should also be addressed. How will the rate of body cooling be affected if shivering is prevented (e.g. IV valium), or if intravenous nicotinic acid is used? What effect will nicotinic acid have on body cooling of hyperthermic and/or comatose patients? Can nicotinic acid facilitate body cooling using cold water sprays or water temperatures above 30°C? Similar tests of vasodilators such as calcium gluconate (7) should be considered. Finally, those individuals who consume large doses of nicotinic acid as therapy for hyperlipidemia (7) are theoretically at increased risk of hypothermia during prolonged swimming/immersion in water at approximately 30°C.



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TABLE 1 - Core temperature (T_c)^{*} during 90 min water immersion trials.

Subject	Nicotinic Acid Treatment	T_{H_2O} (°C)	Initial T_c (°C)	Final T_c (°C)	ΔT_c (°C) ^{**}	Minimum T_c Achieved (°C)
A	without	25	36.8	37.2	+ 0.03	36.8
	with		36.6	36.7	+ 0.01	36.6
B	without	28	37.6	37.3	- 0.02	37.3
	with		36.6	35.7	- 0.01	35.7
C	without	28	36.7	37.4	+ 0.05	36.7
	with		36.6	35.9	- 0.01	35.9
A	with	30	36.4	36.1	- 0.04	35.2
B	with	30	37.1	35.2	- 0.05	35.2

* - values represent the sum of heat dissipated by water immersion and heat generated by shivering

** - during cooling phase, if any